



HIGHWAY INFRASTRUCTURE INVESTMENT AND JOB GENERATION:

A Look at the Positive Employment Impacts
of Highway Investment



U.S. Department
of Transportation

**Federal Highway
Administration**





Summary of Results

Employment Impacts of Federal-Aid Highway Investment

Construction and related activities financed through the Federal-aid program are important sources of employment for persons in many industries throughout the economy. A diverse work force representing all skill levels is supported by investment in highway construction activities, and subsequently in industries which supply materials to the highway construction industry and in other industries throughout the economy. For every \$1 billion of investment, the Federal-aid highway program supports approximately 42,100 total full-time equivalent jobs. Of this total, 27,600 jobs are in highway construction and related (e.g., supplying) industries. This same \$1 billion of Federal-aid highway investment also supports about 14,500 jobs in other industries throughout the economy.



The Economic Benefits of Highway Investment

Highway investment produces economic benefits of many kinds. The most obvious benefits, of course, are the time savings, enhanced safety, and vehicle operating cost reductions experienced by highway users themselves. However, construction and maintenance of highway facilities can also help local, State, regional, and national economies grow by attracting new businesses and by providing access to new markets. Highway investment to reduce congestion and improve levels of service can boost the productivity of U.S. firms by lowering their shipping and logistics costs. For more information on the productivity impacts of highway investment, see companion publication FHWA-PL-96-016, entitled *Productivity and the Highway Network: A Look at the Economic Benefits to Industry of the Highway Network* (1996). Highway investment also stimulates employment growth at the State and regional levels, and even at the national level. The Federal Highway Administration (FHWA) tracks this employment effect in its attempts to estimate various impacts of Federal-aid highway investments (See box on page 3).

Highway Infrastructure Investment and Job Generation

Employment Benefits

An increase in State and local highway capital investment helps to generate employment in the highway construction industry as managers, engineers, specialists, and semi- and unskilled laborers are called upon to construct new roads, resurface existing ones, or perform capital improvements to enhance highway service levels. These investments also generate jobs in many other industries. For instance, industries that supply materials to highway construction are met with increased orders. Increased orders require firms in these "supplying" industries to hire more labor in order to process and deliver materials to construction sites. Also, individuals who work in the highway construction and supplying sectors earn incomes which are subsequently spent within the local, State, and regional economies, generating jobs across many industries and geographic areas.

The FHWA's Role in Estimating the Employment Impacts of Federal-Aid Highway Investment

The U.S. Congress, States, and U.S. Department of Transportation have a keen interest in understanding the benefits and impacts of investing limited public resources. In the case of highways, one of FHWA's primary responsibilities is to manage and track Federal-aid program funding to States and to estimate, from a Federal perspective, the impacts from those investments. To accomplish this, FHWA maintains the Fiscal Management Information System (FMIS) and other data which contain specific characteristics of federally aided projects, including the labor costs associated with each project. The information in these data sets is used to support Federal policy making on many transportation issues by providing decisionmakers with project information, including geographic location, total costs, material costs, labor costs, and urban/rural status, as well as other characteristics.

A Look at the Positive Employment Impacts of Highway



Types of Employment Generated

Federal-aid highway investments help to support employment growth not only in the highway construction sector but also in the industrial sectors that supply materials for highway projects and in the general economy. Traditionally, these effects have been referred to as the direct, indirect, and induced employment impacts of highway investment.

- **Direct jobs** include only jobs held by workers employed at the highway construction site itself. These jobs include all onsite laborers, specialists, engineers, and managers involved with specific highway improvement projects, such as new construction, reconstruction, major widening, restoration and rehabilitation, resurfacing, and bridge replacement.
- **Indirect jobs** are those held by workers in industries that supply highway construction manufacturers with materials and by offsite construction industry workers such as administrative, clerical, and managerial workers. Supplying industry jobs include those supported in stone and clay mining and quarrying, petroleum refining, lumber, steel, concrete, and cement products, as well as in miscellaneous professional services.
- **Induced jobs** are jobs supported throughout the economy when highway construction industry employees spend their wages. Expenditures by these workers on various goods and services stimulate demand for additional employees in these industries, resulting in jobs being supported throughout the general economy.

Recent research funded by FHWA indicates that each \$1 billion of Federal-aid highway program spending in 1996 (1995 dollars) supports approximately 7,900 full-time, onsite highway construction jobs *nationally* (See Table 1). Although men comprise the vast majority (about 93 percent) of highway construction labor working on Federal-aid projects, women's participation has increased from 5.5 to 7.0 percent over the period from 1983 to 1993. Female participation in the industry also spans many occupational categories, from officials (18.9 percent of total) to unskilled laborers (8.5 percent). Additionally, minority workers are more highly represented on FHWA highway construction projects than in the overall labor force (roughly 25 percent and 14 percent, respectively); they hold jobs ranging from officials (18.4 percent of total) to unskilled laborers (36 percent). Further details on the labor characteristics for Federal-aid highway construction projects can be found in the publication "Employment Characteristics of FHWA Highway Construction Projects" (May 1995).

The \$1 billion Federal investment, aside from supporting direct highway construction jobs, also supports approximately 19,700 *indirect* jobs and 14,500 *induced* jobs. A summary of the methodology, data, and assumptions utilized in this research is included in the section of this publication entitled Approaches to Analysis.

Table 1. Direct, Indirect, and Induced Employment Impacts of Federal-Aid Highway Investment - Per \$1 Billion Federal Investment in 1996 (in 1995 dollars)

Type of Employment	Jobs Supported Per \$1 Billion Federal Spending	Modeling Approach ¹
Direct	7,900	FHWA HIGHWAY1 Model
Indirect	19,700	Dynamic Input-Output Model
Induced	14,500	Dynamic Input-Output Model
Total	42,100	—

¹ Methodology is discussed further in the section of this publication entitled Approaches to Analysis

Important to Note

The most common misconception regarding job generation estimates is that, in the absence of highway spending, workers in “generated” jobs would be unemployed. This is not usually the case. Job generation estimates within FHWA’s study refer to *gross* job creation, in the sense that these jobs are directly attributable to the project and that the generated employment from alternative uses of the same funds is not quantified.

The potential for net employment gains from highway infrastructure investment depends on the labor intensity of the highway construction and related supply industries in comparison with other industries where an alternative investment might be made. Past research has revealed that federally aided highway construction and maintenance work is one of the most labor-intensive construction activities studied and, therefore, investment in highways may result in net employment gains over public investment in alternative construction activities.

Past FHWA estimates of the direct, indirect, and induced employment impacts of highway investment have been slightly larger in absolute terms than FHWA’s latest estimates. Most of this difference is explained by inflationary impacts. For instance, because the employment impacts of highway investment are measured in terms of a fixed dollar amount (e.g., per \$1 billion), increases in the hourly wage of highway construction employees over the years have meant that fewer employees can be supported per \$1 billion investment in highways. Technological improvements likely have also had a negative impact on employment generation per project, as newer and more efficient equipment has been substituted for labor. Methodological differences in the studies and changes in labor markets throughout the economy over the last several years account for the remaining discrepancies. FHWA’s latest estimates are consistent with results derived from other recent studies examining the employment impacts of highway investment.



Approaches to Analysis

Because data and technical considerations vary, FHWA used an approach to estimate the direct employment impacts that was distinct from that used to estimate the indirect and employment impacts of Federal-aid highway investment. These two distinct approaches are explained below.

- **Direct Employment**

To estimate the direct employment impacts resulting from Federal-aid highway investment, FHWA used internal data from specific Federal-aid projects completed during the period from 1989 through 1992. This data contains specific labor and materials cost data on all Federal-aid primary, urban, and

Interstate system highway projects where total project costs exceed \$1 million, as reported by highway contractors to FHWA. The database contains complete information on more than 4,600 projects, including labor costs, hours of employment, total project costs, region, urban/rural status of project, improvement type, and other project-specific information.

Using this data and an assumption from previous FHWA studies on the average number of hours worked per year per employee (1,600 or 40 weeks), multiple regression analysis was used to estimate the number of full-time equivalent jobs supported per \$1 billion of Federal-aid highway investment. See Table 1 for specific results of this research; see the publication “FHWA Direct Employment Impacts: A Quantitative Analysis” (May 1995) for details on the regression analysis. As part of this analysis, FHWA developed, with contractor assistance, a PC-based model called the FHWA HIGHWAY 1 Model, which allows for the estimation of direct employment impacts from Federal-aid highway investment by region of the country as well as other factors (See box on page 9).

FHWA's HIGHWAY1 Regional Employment Estimation Model

The FHWA has developed a flexible, user-friendly PC model (HIGHWAY1 Model) that allows for direct employment impact analysis at the regional level. The user has the ability to set parameters such as the total program funds appropriated to each region, the mix of Federal-aid improvement projects undertaken in each region, and the urban/rural mix of projects. The software asks the user to enter

- total Federal funds,
- year of proposed spending,
- price deflator, and
- whether or not State matching funds should be included in the analysis.

The user is given the option to directly input or select default values (based on the 1993 highway program composition data) for

- distribution total of spending across FHWA regions,
- composition of spending by improvement type (new construction, 3-R, bridge, etc.) within each region, and
- regional program expenditures by urban/rural status.

The HIGHWAY1 Model does not reflect the temporal, or time-sensitive, relationship between project expenditures and direct employment generation. For instance, there is no lag effect incorporated into the obligation of Federal-aid highway funds and their expenditure.

For more information on the FHWA HIGHWAY1 Model, or to receive a copy of the software, please contact the FHWA Office of Policy Development, Transportation Studies Division, at (202) 366-9233.

- **Indirect and Induced Employment**

The tool used to estimate the indirect and induced employment impacts of Federal-aid highway investment is the dynamic input-output model. Input-output models are constructed to replicate, major industry by major industry, the overall economy of a State, region, or national economy by accounting for the interactions that spending within one sector may have on others. Using a leading commercial dynamic input-output model, FHWA estimated the national-level indirect and induced employment impacts of Federal-aid highway investment, as well as the national level direct employment results that were used for comparison with internal FHWA estimates derived from the FHWA Direct Employment Estimation (or HIGHWAY1) Model.

For more information, contact:
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